How can I prepare a protocol for a GCT optimization run?

Author

Dr. Ronald Edler
Revvity, Inc.

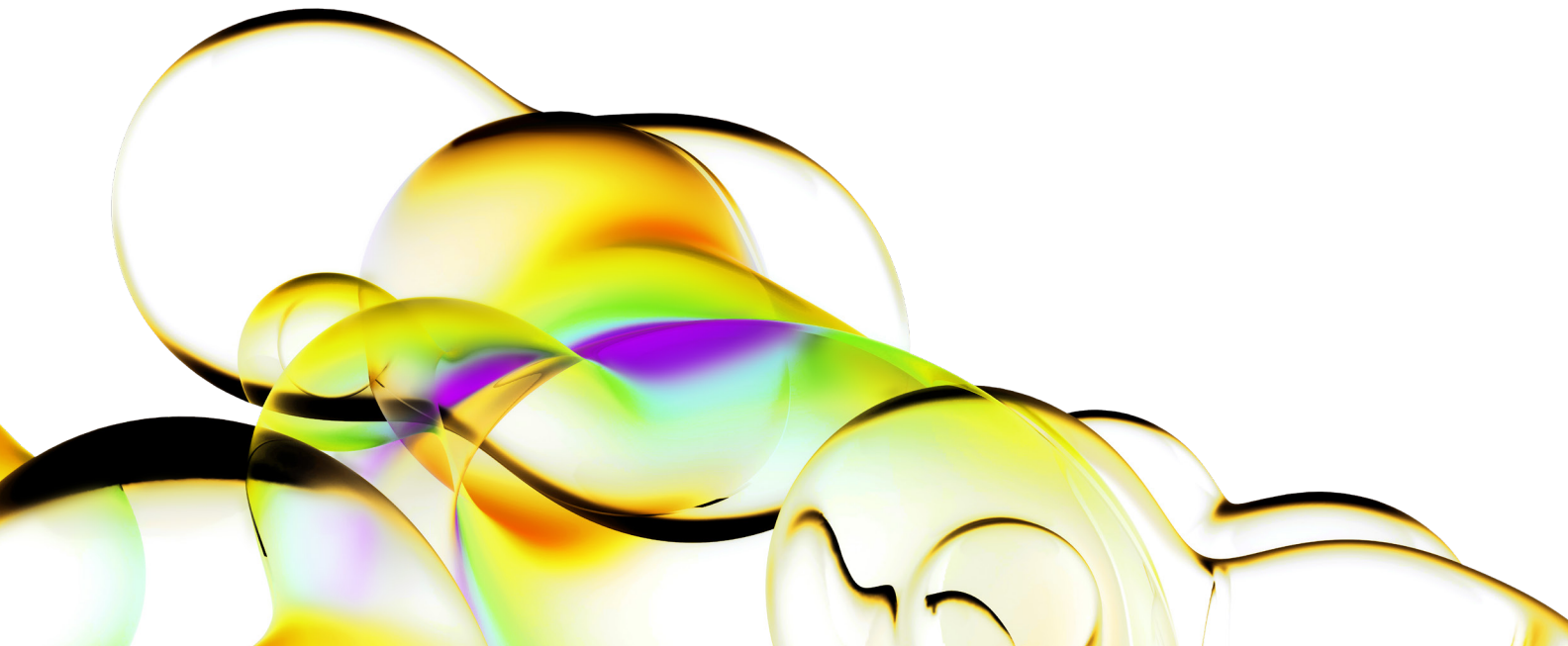
Introduction

The Quantulus™ GCT 6220 has what is known as Guard Compensation Technology. For details of this technique, please refer to the literature.[1,2] In order for this technique to be used successfully for background reduction, it is necessary to carry out an optimization run. A suitable background sample is measured at the customer's site and the counting efficiency of the guard detector for background signals is determined. This application note describes what a suitable sample should look like and how a protocol for performing the optimization run is created.

Preparation of a suitable background sample

The background sample should be as identical as possible to the samples to be measured but should not contain any radioactivity. It is particularly important

1. that the sample is measured in the same vial type (glass or plastic).
2. that the volume matches the volume of the samples to be measured.
3. that the ratio of sample to cocktail matches the unknown samples.
4. and that the quench corresponds to the samples to be measured.



Preparation of the protocols

Since the protocol for the optimization run has some special features, a protocol with the name Optimize_GCT_Strength_Factors.lsa is supplied with every Quantulus GCT 6220.
This file is write-protected and cannot be changed.
This is sensible as this protocol can only be changed in a few places. To do this for your application, select “Open Assay...” in the “File” menu of the QuantaSmart software as shown in the following figure.

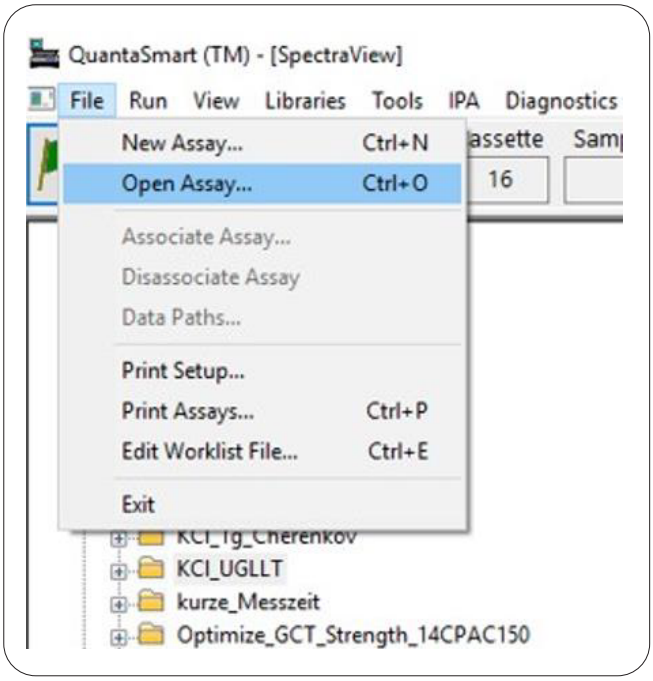


Figure 1: The File Menu

Click on “Open Assay...” and a list of all available protocols in the Assays Directory will be displayed as shown in Figure 2.

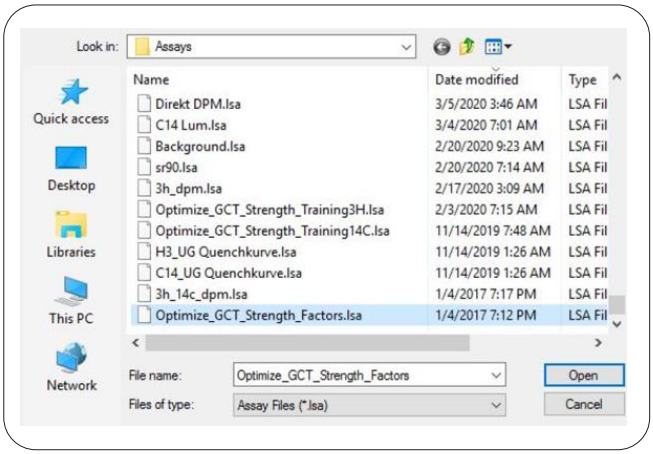


Figure 2: The Open Assay Window

Select the factory-installed protocol “Optimize_GCT_Strength_Factors.lsa” and click on “Open”. The protocol is now displayed, usually the “Count Conditions” tab of the protocol appears on the screen.

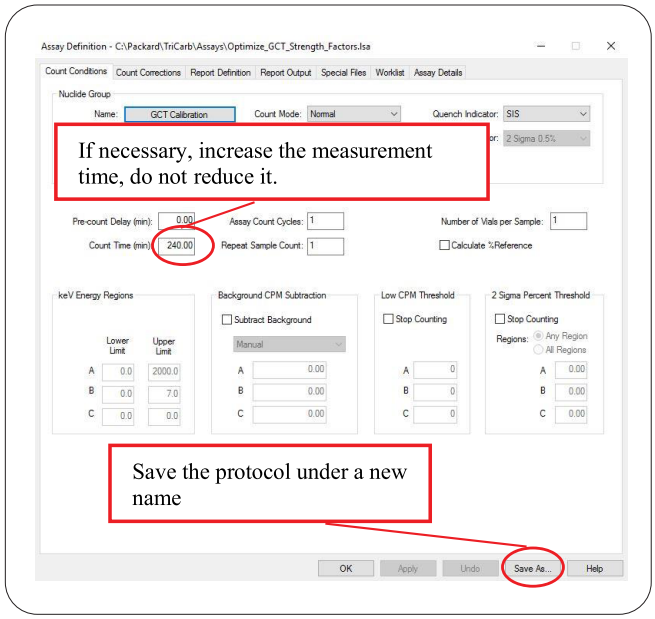


Figure 3: Saving under a new name

Press the “Save As ...” button at the bottom of the page and enter a new name for this protocol. Then press the “Save” button and the protocol will be saved under the new name you specified. The title on the screen now shows this new name and you can continue editing on the screen. Please note that only a few parameters may be changed in the protocol so that the optimization run works properly. Apart from the measurement time, nothing should be changed on the “Count Conditions” tab.

The preset counting time of 240 minutes must be regarded as the minimum counting time. You can extend the counting time to improve the counting statistics, but the measurement time should not be reduced under any circumstances. The Quantulus GCT has a very low background and therefore long counting times are required to get reasonable counting statistics. Since only one optimization run is required for each application, this longer measurement time can usually be accepted. However, such an optimization run should be carried out again if the performance of the measuring scintillation counter changes. Therefore, such new measurements should be repeated after about a year. A new measurement is also required if the location of the device changes, for example due to a move or if you change the sample volumes, the cocktail,

the vial material, or other parameters influencing the measurement. Please do not change anything on the "Count Corrections" index card. The "Static Controller" is activated by default, otherwise do not change anything here.

Please do not change anything in the tabs for "Report Definition" and "Report Output". This is particularly important because settings are very important here and files are stored that are essential for determining the counting efficiency of the guard detector.

A very important change must be made in the "Special Files" tab, which can be seen in Figure 4. The "Create Optimization Set" function must be activated in the "GCT Optimization" area and you must enter a new name for the set to be created, otherwise the set that is named in this field would be overwritten. As a rule, however, this is not desired.

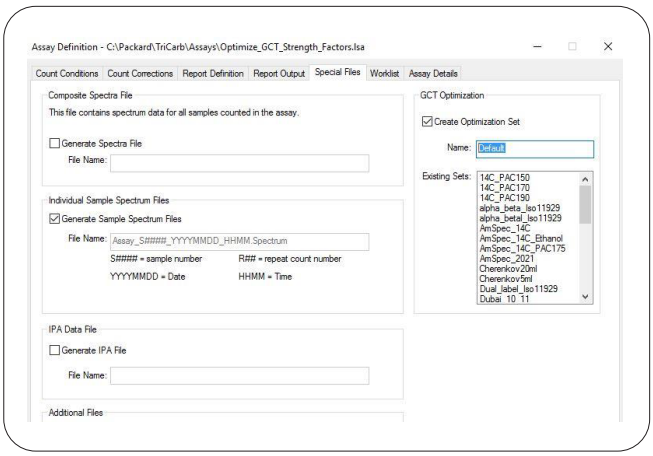


Figure 4: Preparing a new set for the optimization

In this way, individual sets for optimizing background reduction can be created for very different applications. If you have many different applications and therefore perform a lot of optimizations, the names should contain details of the applications such as volume, cocktail, quench etc. The individual sets created can be viewed in Windows Explorer in the Packard directory in the GCT Libraries subdirectory, as shown in Figure 5.

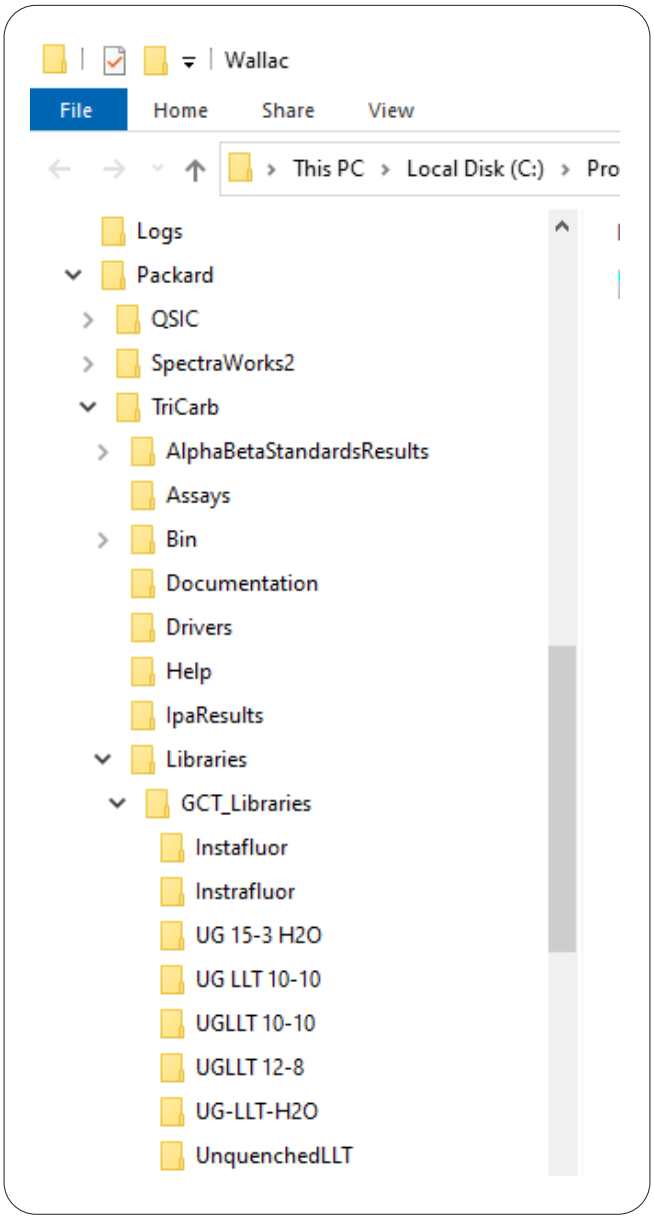


Figure 5: GCT Libraries

If a measurement of an unknown sample is to be carried out now, a link with the optimization set must be carried out in the measurement protocol. To do this, please open your measurement protocol and open the “Count Conditions” tab as shown in Figure 6.

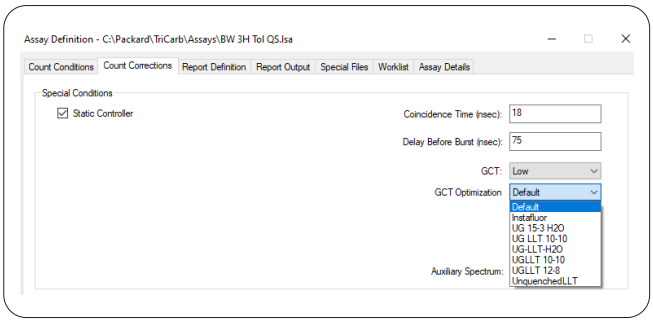


Figure 6: Link of measurement protocol with the optimization set

Please select “Low” or “High” in the “GCT:” pull down menu. High is recommended for low-energy nuclides such as ^{3}H, ^{55}Fe, ^{241}Pu, or Cerenkov measurements while Low is recommended for nuclides with energies such as ^{14}C or higher-energy nuclides. In the pull-down menu “GCT Optimization” please select the desired optimization set. The pull-down menu shows all sets that are preset on the instrument and also the sets you have created. This completes the link between the optimization run and the measurement protocol for unknown samples. The protocol can now be saved and used for GCT optimizations.

Literature

1. Brad Ward, R. Edler; “How does GCT work in the Quantulus GCT 6220?”, Revvity LAS (Germany) GmbH, Juli 2017.

2. R. H. W. Edler; An Introduction to the Scintillation Technology for the Measurement of Radionuclides, 1st Edition, Bremen 2020, ISBN 978-3-00-020422-7.

Copyright ©2025, Revvity, Inc. All rights reserved.
For research use only. Not for use in diagnostic procedures.